

Claims:

1. A method for identifying a substance which inhibits the formation of a bacterial biofilm, comprising

providing a host cell expressing at least one protein encoded by a gene selected
5 from the group consisting of *lctR*, *recA*, *mdh*, *rbsB*, *msrA*, *finA*, *tatE*, *pspF*, *cpxP*, *spy*, *ycfJ*,
ycfR, *yoaB*, *yqcC*, *yggN*, *ymcA*, *yccA*, *yfcx*, *yghO*, *ycP*, and *ycuB*;

contacting the host cell with the substance;

measuring the level of at least one protein or at least one RNA transcript of the at
least one gene after said contacting; and

10 comparing the level of the at least one of the protein or RNA transcript of the at
least one gene after said contacting with a host cell not contacted with the substance;
wherein a reduced level of the at least one protein or the at least one RNA transcript
relative to the cell not contacted with the substance indicates that the substance inhibits
the formation of a bacterial biofilm.

15 2. The method of Claim 1, wherein the bacterial biofilm is an *E. coli* biofilm.

3. The method of Claim 1, wherein the at least one gene is *yccA*.

20 4. The method of Claim 1, wherein the at least one gene is *ycfJ*.

5. The method of Claim 1, wherein the at least one gene is *yceP*.

6. The method of Claim 1, wherein the at least one gene is *lctR*.

7. The method of Claim 1, wherein the at least one gene is *recA*.

25 8. The method of Claim 1, wherein the at least one gene is *mdh*.

- 9. The method of Claim 1, wherein the at least one gene is *rbsB*.
- 10. The method of Claim 1, wherein the at least one gene is *msrA*.
- 11. The method of Claim 1, wherein the at least one gene is *finA*.
- 12. The method of Claim 1, wherein the at least one gene is *tatE*.
- 5 13. The method of Claim 1, wherein the at least one gene is *pspF*.
- 14. The method of Claim 1, wherein the at least one gene is *cpxP*.
- 15. The method of Claim 1, wherein the at least one gene is *spy*.
- 16. The method of Claim 1, wherein the at least one gene is *ycfR*.
- 17. The method of Claim 1, wherein the at least one gene is *yoaB*.
- 10 18. The method of Claim 1, wherein the at least one gene is *yqcC*.
- 19. The method of Claim 1, wherein the at least one gene is *yggN*.
- 20. The method of Claim 1, wherein the at least one gene is *ymcA*.
- 21. The method of Claim 1, wherein the at least one gene is *yfcx*.
- 22. The method of Claim 1, wherein the at least one gene is *yghO*.
- 15 23. The method of Claim 1, wherein the at least one gene is *yceP*.
- 24. The method of Claim 1, wherein the at least one gene is *ycuB*.
- 25. The method of Claim 1, further comprising contacting a bacterial biofilm with the substance and measuring the inhibition of the bacterial biofilm growth relative to a bacterial biofilm not contacted with the substance.
- 20 26. A substance obtained by the method of Claim 1.
- 27. A substance obtained by the method of Claim 2.
- 28. A substance obtained by the method of Claim 3.
- 29. A substance obtained by the method of Claim 4.
- 30. A substance obtained by the method of Claim 5.
- 25 31. A substance obtained by the method of Claim 6.

32. A method of inhibiting the formation of a bacterial biofilm, comprising contacting the biofilm with at least one substance identified according to Claim 1.

33. A method of inhibiting the formation of a bacterial biofilm on at least on substrate, comprising contacting the at least one substrate on which a biofilm is forming with at least one substance identified according to Claim 1.

34. A method of treating at least one substrate on which a biofilm has developed, comprising contacting the at least one substrate with at least one substance identified according to Claim 1.

35. A method of inhibiting the formation of a biofilm on at least one substrate which is susceptible to biofilm formation, comprising contacting the at least one substrate with at least one substance identified according to Claim 1.

36. A method for detecting differentially expressed polynucleotide sequences which are specifically correlated with a mature bacterial biofilm, said method comprising: obtaining a polynucleotide sample; labeling said polynucleotide sample by reacting said polynucleotide sample with a labeled probe immobilized on a solid support wherein said probe comprises at least one polynucleotide sequence selected from the group consisting of *lctR*, *recA*, *mdh*, *rbsB*, *msrA*, *finA*, *tatE*, *pspF*, *cpxP*, *spy*, *ycfJ*, *ycfR*, *yoaB*, *yqcC*, *yggN*, *ymcA*, *yccA*, *yfcx*, *yghO*, *ycP*, and *ycuB* or an expression product encoded by any of the polynucleotide sequences; and detecting a polynucleotide sample reaction product.

37. The method of claim 36, further comprising obtaining a control polynucleotide sample, labeling said control sample by reacting said control sample with said labeled probe, detecting a control sample reaction product, and comparing the amount of said polynucleotide sample reaction product to the amount of said control sample reaction product.

38. The method of claims 36, wherein RNA or mRNA is isolated from said polynucleotide sample.
39. The method of claim 38, wherein mRNA is isolated from said polynucleotide sample and cDNA is obtained by reverse transcription of said mRNA.
- 5 40. The method of claim 36, wherein said labeling is performed by hybridizing the polynucleotide sample with the labeled probe.
41. The method of claim 36, wherein said method is used for detecting mature bacterial biofilms.
42. The method of claim 36, wherein the bacterial biofilm is an *Escherichia coli* biofilm.
- 10 43. The method of claim 36, wherein the expression product is detected and is involved in a receptor-ligand interaction, and the detecting comprises detecting an interaction between a receptor and a ligand.
44. The method of claim 36, wherein the label is selected from the group consisting of radioactive, colorimetric, enzymatic, molecular amplification, bioluminescent, fluorescent labels, and mixtures thereof.
- 15 45. A method of detecting significantly overexpressed genes correlated with a mature bacterial biofilm comprising detecting at least one polynucleotide sequence or subsequence of a polynucleotide selected from the group consisting of *lctR*, *recA*, *mdh*, *rbsB*, *msrA*, *finA*, *tatE*, *pspF*, *cpxP*, *spy*, *ycfJ*, *ycfR*, *yoaB*, *yqcC*, *yggN*, *ymcA*, *yccA*, *yfcx*, *yghO*, *ycP*, and *ycuB* or detecting at least one product encoded by said polynucleotide library in a sample obtained from a patient.
- 20 46. A method according to claim 45, further comprising comparing an amount of said at least one polynucleotide sequence or subsequence or product encoded by said polynucleotide sequence with an amount of said polynucleotide sequence or

subsequence or product encoded by said polynucleotide sequence or subsequence obtained from a control sample.

47. The method according to claim 45, comprising extracting mRNA from said polynucleotide sample.

5 48. The method according to claim 47, comprising reverse transcribing said mRNA to cDNA.

49. The method according to claim 45, comprising hybridizing said at least one polynucleotide sequence or subsequence with mRNA or cDNA from the polynucleotide sample.

10 50. The method according to claim 45, wherein the expression product is detected and is involved in a receptor-ligand interaction, and the detecting comprises detecting an interaction between a receptor and a ligand.

51. A polynucleotide library useful in the molecular characterization of a mature bacterial biofilm, said library comprising a pool of polynucleotide sequences or subsequences thereof wherein said sequences or subsequences are overexpressed in mature bacterial biofilms, further wherein said sequences or subsequences correspond substantially to one or more polynucleotide sequences selected from the group consisting of *rne*, *lctR*, *dinI*, *glpQ*, *mdh*, *sixA*, *lamB*, *rbsB*, *gadA*, *pspA*, *pspB*, *pspC*, *pspD*, *tatE*, *cpxP*, *rseA*, *rpoE*, *spy*, *yebE*, *yqcC*, *yfcX*, *yjbO*, *yceP*, and *ygiB*.

20 52. The polynucleotide library of claim 51, wherein the library further comprises one or more polynucleotide sequences or subsequences thereof selected from the group consisting of *recA*, *msrA*, *fimA*, *pspF*, *ycfJ*, *ycfR*, *yoaB*, *yggN*, *yneA*, *yccA*, and *yghO*.

53. The polynucleotide library of claim 51, wherein the library further comprises one or more polynucleotide sequences or subsequences selected from the group consisting of *RplY*, *recA*, *cyoD*, *sucA*, *fdhF*, *cyoC*, *nifU*, *sucD*, *sfsA*, *nifS*, *fadB*, *ucpA*, *fisL*, *sulA*, *eco*,

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msrA, pspD, fimA, fimI, pspE, pspF, cutC, sodC, rseB, ycfJ, ycfR, yoaB, yhhY, yggN, yneA, ybeD, ydcI, yddL, yccaA, yrdD, ybjF, yihN, 1228, ycfL, yiaH, and yqeC.

54. The polynucleotide library of claim 51, wherein the library further comprises one or

more polynucleotide sequences or subsequences thereof selected from the group

consisting of *lysU, miaA, rluC, rplY, srl, cspD, dniR, fruR, idnR, lacI, nac, rnk, rpoS,*

ttk, b0299, dinG, dinP, exo, intA, recA, recN, sbmC, xthA, aceA, aceB, aldA, atpA,

cyoA, cyoC, cyoD, dctA, fdhF, fdoG, glpD, glpK, nifU, pckA, sdhB, sdhD, sucA, sucB,

sucD, xdhD, agp, gcd, glgS, glpX, malE, malF, malS, mglA, mglB, mrsA, pgm, rbsC,

rbsD, sfsA, ansB, argC, argR, idnD, leuD, metH, nifS, putP, metK, pneu, ubiE, fabA,

fadB, fadE, fadL, pgpA, pssA, uppS, idnO, ucpA, ftsL, sulA, dnaJ, dnaK, eco, fkpA,

glnE, htpG, htpX, msrA, amiB, ddg, fhiA, fimA, fimI, htrL, lepB, mraW, nlpB, nlpC,

ompC, ompG, pspE, pspF, chaA, chaC, cutC, cysP, cysU, fur, modA, modB, modC,

modE, sodC, trkH, rseB, ycfJ, ycfR, yoaB, yhhY, yggN, yneA, ybeD, ydcI, yddL, yccaA,

yrdD, ybjF, yihN, ycfT, yeeF, yfiE, yeeD, yliH, yfcM, ybiX, yfhF/nifA, ygfQ, ybhR,

ybdH, yihR, ydcT, ygiS, ybaZ, ydaM, tfaR, yceL, yheT, yjdC, ybiW, ybiF, ynaI, yceE,

yhdP, ygjE, csiE, yfdE, yeeE, yegQ, glcA, yfdW, yfeT, ygjK, ydeW, b1228, ycfL, yghO,

yiaH, yqeC, ycfT, yhjJ, yceB, ybiX, ygiQ, yagV, yoeA, ybhQ, ybcI, ybbF, ybgl, yncH,

yfbM, yjiM, yjfO, ychN, ynaC, ymfE, yfcN, yrbC, yfdQ, yfeY, ygiM, yhgA, yhjQ, yfcF,

yfcI, yjiD, yfbP, yphB, yfbN, ylbH, ybhM, yrbL, yjfY, ynfA, yajI, yedI, yafZ, yjjU, yfhH,

yafN, yrbE, yfgC, yffQ, ycaK, yfeS, b4250, ybgA, yeeA, ypfI, b2394, yegK, ybcJ, yhiN,

ypfG, ydiY, yjjJ, ycaP, and yfgJ.

55. The polynucleotide library of claim 51, wherein said biofilm are an *Escherichia coli* biofilm.

56. The polynucleotide library of 51, wherein said one or more polynucleotide sequences or subsequences of said pool are immobilized on a solid support to form a polynucleotide array.

57. The polynucleotide library of claim 56, wherein the solid support is selected from the group consisting of a nylon membrane, glass slide, glass beads, and a silicon chip.

58. A polynucleotide array useful to detect a mature bacterial biofilm comprising an immobilized polynucleotide library according to Claim 51.